We claim

- 1 1. A method of in-situ cleaning an inductively coupled plasma reaction chamber, the
- 2 method complising introducing remotely formed, preselected activated reactant species
- 3 into the reaction chamber.
- 1 2. A method of *in-situ* cleaning an inductively coupled plasma reaction chamber, the
- 2 method comprising introducing gases which contain preselected reactant species into the
- 3 reaction chamber.
- 1 3. A method for plasma enhanced fabrication of a semiconductor substrate in an
- 2 inductively coupled plasma reaction chamber, said chamber having an inside surface, the
- 3 method comprising the steps of:
- 4 contacting the substrate with a plasma containing preselected reactant species for
- 5 a preselected fabrication step;
- 6 removing the substrate from the leaction chamber after the fabrication step;
- 7 removing deposited material in-situ from the inside surface of the inductively
- 8 coupled plasma reaction chamber by introducing remotely formed, preselected activated
- 9 reactant species into the reaction chamber.
- 1 4. The method of Claim 3 wherein the preselected fabrication step is plasma
- 2 enhanced sputtering.
- 1 5. The method of Claim 3 wherein the preselected fabrication step is plasma
- 2 enhanced etching.

- 1 6. The method of Claim 3 wherein the preselected fabrication step is plasma
- 2 enhanced chemical vapor deposition.
- 1 7. The method of Claim 3 wherein the plasma is a high density plasma.
- 1 8. A method for plasma enhanced fabrication of a semiconductor substrate in an
- 2 inductively coupled plasma reaction chamber, said chamber having an inside surface, the
- 3 method comprising the steps of:
- 4 contacting the substrate with a plasma containing preselected reactant species for
- 5 a preselected fabrication step;
- for removing the substrate from the reaction chamber after the fabrication step;
- 7 removing deposited material in-situ from the inside surface of the inductively
- 8 coupled plasma reaction chamber/by/introducing gases which contain preselected reactant
- 9 species into the reaction charaber
- 1 9. The method of Claim 8 wherein the preselected fabrication step is plasma
- 2 enhanced sputtering.
- 1 10. The method of Claim 8 wherein the preselected fabrication step is plasma
- 2 enhanced etching.
- 1 11. The method of Claim 8 wherein the preselected fabrication step is plasma
- 2 enhanced chemical vapor deposition.

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13. A method for PECVD deposition of metal films on a substrate in an inductively
coupled (IC) plasma enhanced chemical vapor deposition (PECVD) reactor comprising:
placing the substrate in the inductively coupled PECVD reaction chamber having
an inside and an outside;
maintaining the reaction chamber under vacuum pressure;
introducing at least a metal precursor deposition gas into the reaction chamber for
metal deposition on the substrate;
generating a plasma from the gas within the reaction chamber using a power
source inductively coupled to the reaction chamber;
removing the substrate from reaction chamber; and
in-situ removing deposited material from the inside of the chamber to remove any
blocking of the inductive power couple to the reaction chamber.

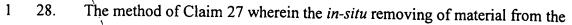
The method of Claim 8 wherein the plasma is a high density plasma.

- 1 14. The method of Claim 13 wherein the plasma generated in the reaction chamber is 2 a high density plasma.
- 1 15. The method of Claim 13 wherein the *n-situ* removing of material is accomplished
- 2 by introducing into the reaction chamber a chemical species generated in a remotely
- 3 formed plasma for etching the material.
- 1 16. The method of Claim 13 wherein the *in-situ* removing of material is accomplished
- 2 by introducing into the reaction chamber remotely formed activated reactant species for
- 3 etching the material.

- 1 17. The method of Claim 13 wherein the *in-situ* removing of material is accomplished
- 2 by introducing into the reaction chamber gases for etching the material.
- 1 18. The method of Claim 13 wherein the vacuum pressure maintained in the reaction
- 2 chamber is in the range of 1 to 10 mtorr.
- 1 19. The method of Claim 14 wherein the vacuum pressure maintained in the reaction
- 2 chamber is in the range of 1 to 10 mtorr.
- 1 20. The method of Claim 15 wherein the vacuum pressure maintained in the reaction
- 2 chamber is in the range of 1 to 10 mtorr.
- 1 21. The method of Claim 16 wherein the vacuum pressure maintained in the reaction
- 2 chamber is in the range of 1 to 10 mtorr.
- 1 22. The method of Claim 17 wherein the vacuum pressure maintained in the reaction
- 2 chamber is in the range of 1 to 10 mtorn
- 1 23. A semiconductor device produced by the process comprising the steps of:
- 2 placing a substrate in an inductively coupled chemical vapor deposition chamber
- 3 having an inside and an outside;
- 4 maintaining the chamber under vacuum pressure;
- introducing a metal precursor deposition gas and a carrier gas into the chamber for
- 6 metal deposition on the substrate;

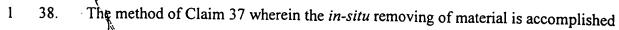
- generating a plasma from the gases in the chamber using a power source
 inductively coupled to the reaction chamber;
 removing the substrate from reaction chamber; and
 in-situ removing of deposited material from the inside of the chamber to remove
 any blocking of the inductive power couple to the reaction chamber.
- 1 24. The device of Claim 23 wherein the *in-situ* removing of material is accomplished 2 by introducing into the reaction chamber a chemical species generated in a remotely
- 3 formed plasma for etching the material.
- 1 25. The method of claim 23 wherein the *in-situ* removing of material is accomplished
- 2 by introducing into the reaction chamber remotely formed activated reactant species for
- 3 etching the material.
- 1 26. The device of Claim 23 wherein the *in-situ* removing of material is accomplished
- 2 by introducing into the reaction chamber gases for etching the material.
- 1 27. A method of forming a metal layer on a semiconductor wafer, using an
- 2 inductively coupled, plasma enhanced chemical vapor deposition chamber, the method
- 3 comprising the steps of:
- forming a plasma containing a metal precursor deposition gas; exposing the wafer
- 5 to the plasma sufficiently to deposit a metal layer thereon; removing the wafer from the
- 6 chamber and in-situ cleaning the chamber to remove any material blocking the inductive
- 7 couple to the chamber.

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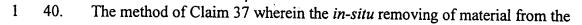


- 2 chamber is accomplished by introducing into the reaction chamber a remotely formed
- 3 plasma containing chemicals for etching the material.
- 1 29. The method of Claim 27 wherein the in-situ removing of material from the
- 2 chamber is accomplished by introducing into the reaction chamber gases for etching the
- 3 material.
- 1 30. A method of altering a substantially planar surface on a semiconductor wafer,
- 2 using an inductively coupled, plasma chamber, the method comprising the steps of:
- forming a plasma containing a reactant conductive material gas; exposing the
- 4 wafer to the plasma sufficiently to alter a surface layer thereon; removing the wafer from
- 5 the chamber and in-situ cleaning the chamber to remove any material blocking the
- 6 inductive couple to the chamber.
- 1 31. The method of Claim 30 wherein the *in-situ* removing of material from the
- 2 chamber is accomplished by introducing into the reaction chamber a remotely formed
- 3 plasma containing chemicals for etching the material.
- 1 32. The method of Claim 30 wherein the in-ritu removing of material from the
- 2 chamber is accomplished by introducing into the reaction chamber gases for etching the
- 3 material.
- 1 33. A method of making a semiconductor device, comprising the steps of:

- 2 exposing a substrate to products formed in an inductively coupled plasma chamber
- 3 through the interaction of a noble gas plasma and a reactant-species-forming compound
- 4 to alter a metal layer on at least a portion of the substrate, in-situ removal of deposited
- 5 material from the chamber.
- 1 34. The method of Claim 33 wherein the *in-situ* removing of material is accomplished
- 2 by introducing into the reaction chamber a chemical species generated in a remotely
- 3 formed plasma for etching the material.
- 1 35. The method of Claim 33 wherein the *in-situ* removing of material is accomplished
- 2 by introducing into the reaction chamber remotely formed activated reactant species for
- 3 etching the material.
- 1 36. The method of Claim 33 wherein the in-situ removing of material from the
- 2 chamber is accomplished by introducing into the reaction chamber gases for etching the
- 3 material.
- 1 37. A method of making a semiconductor device, comprising the steps of:
- 2 exposing a substrate to products formed in an inductively coupled plasma chamber
- 3 through the interaction of a noble gas plasma and reactant-species-forming compound to
- 4 alter a surface on at least a portion of the substrate, in-situ removal of deposited material
- 5 from the chamber.



- 2 by introducing into the reaction chamber a chemical species generated in a remotely
- 3 formed plasma for etching the material.
- 1 39. The method of claim 37 wherein the in-situ removing of material is accomplished
- 2 by introducing into the reaction chamber remotely formed activated reactant species for
- 3 etching the material.



- 2 chamber is accomplished by introducing into the reaction chamber gases for etching the
- 3 material.

